FIG.1

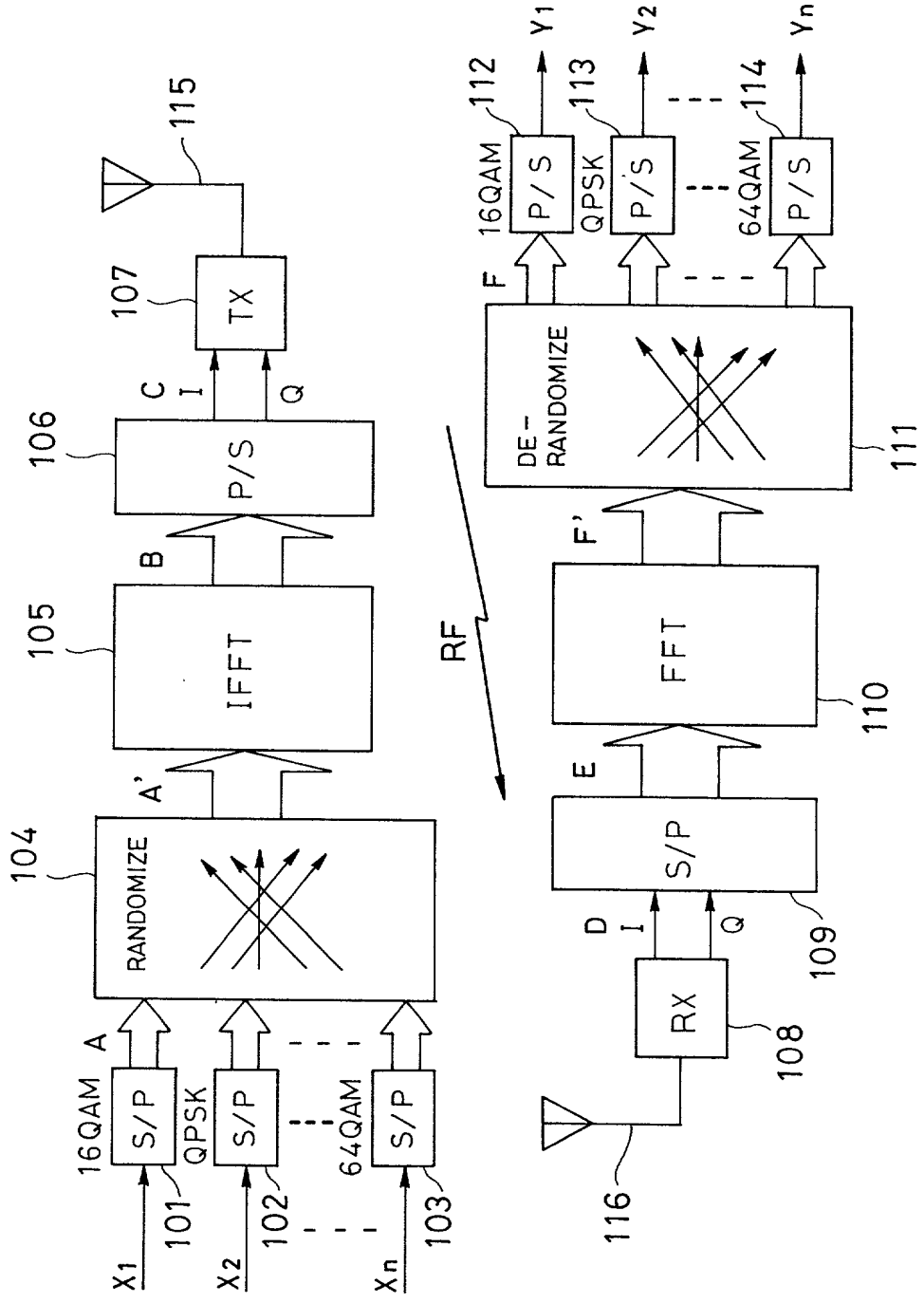

X1
X2
Xn
16QAM
QPSK
64QAM
S/P
101
102
103
A
RANDOMIZE
104
A'
IFFT
105
B
P/S
106
C
I
Q
TX
107
115
RF
116
RX
108
D
I
Q
S/P
109
E
FFT
110
F'
DE-
RANDOMIZE
111
F
16QAM
QPSK
64QAM
P/S
112
113
114
Y1
Y2
Yn

FIG. 2

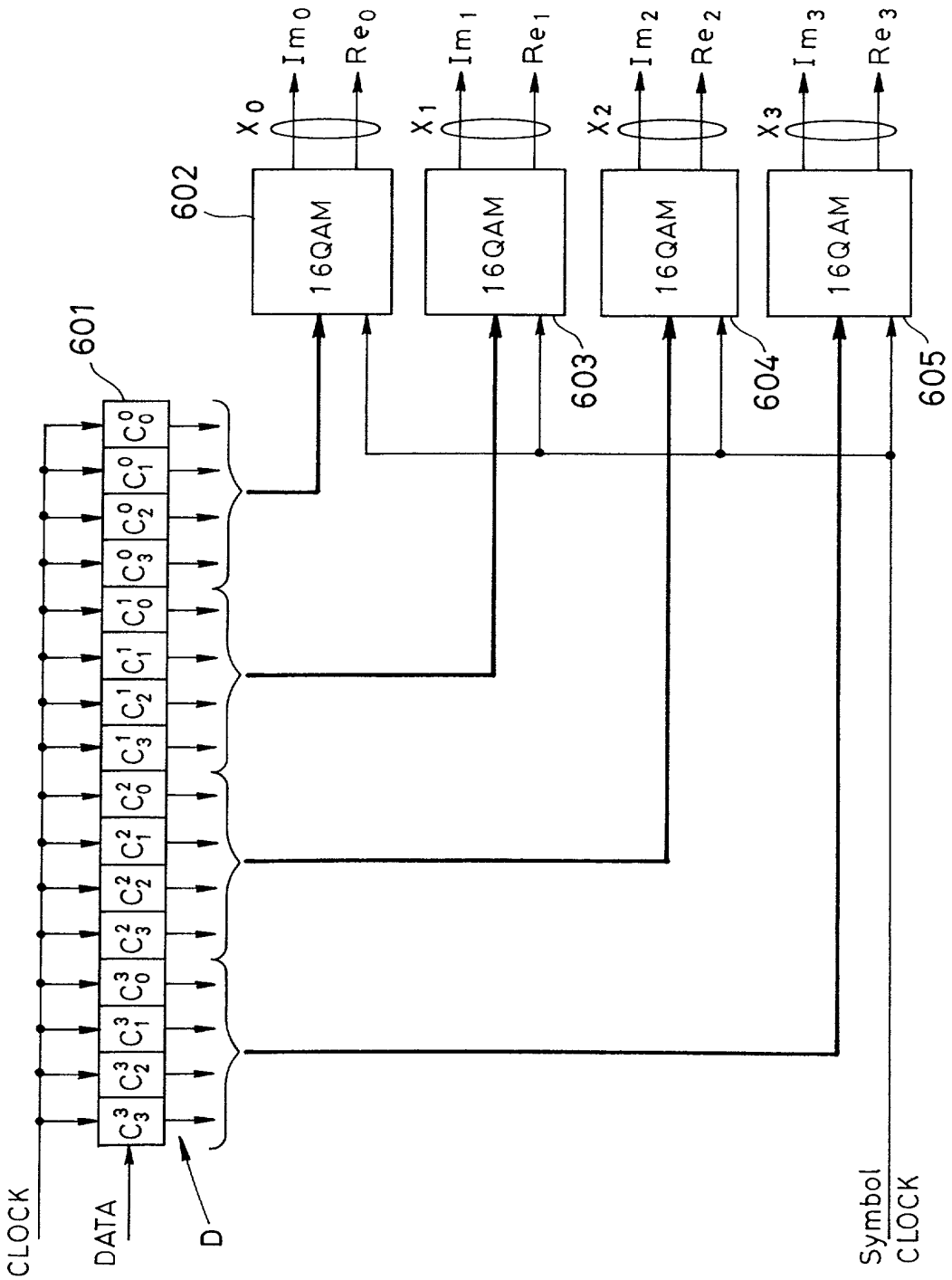

601
602
603
604
605
16QAM
16QAM
16QAM
16QAM
X0
X1
X2
X3
Im0
Re0
Im1
Re1
Im2
Re2
Im3
Re3
CLOCK
DATA
D
Symbol CLOCK

FIG.3

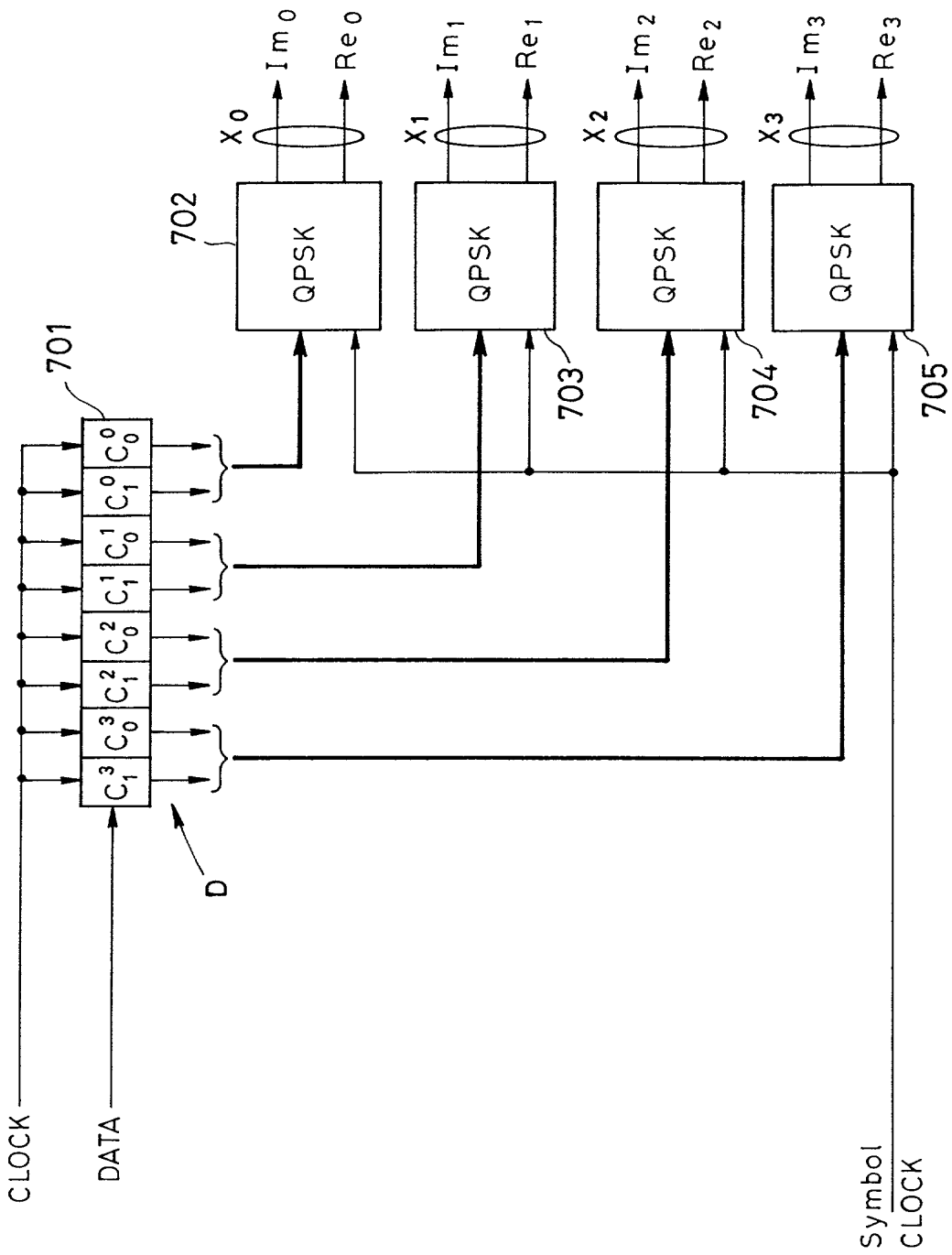

CLOCK
DATA
D
701
C_1^3 C_0^3 C_1^2 C_0^2 C_1^1 C_0^1 C_1^0 C_0^0
702
703
704
705
QPSK
QPSK
QPSK
QPSK
X_0
X_1
X_2
X_3
Im_0 Re_0
Im_1 Re_1
Im_2 Re_2
Im_3 Re_3
Symbol CLOCK

FIG. 4

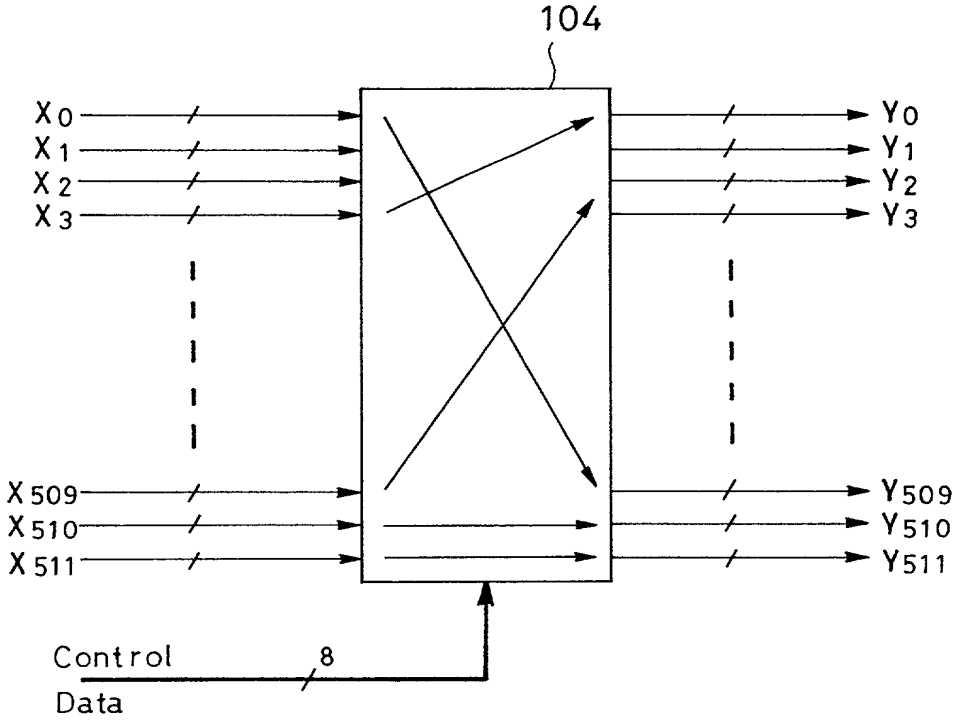
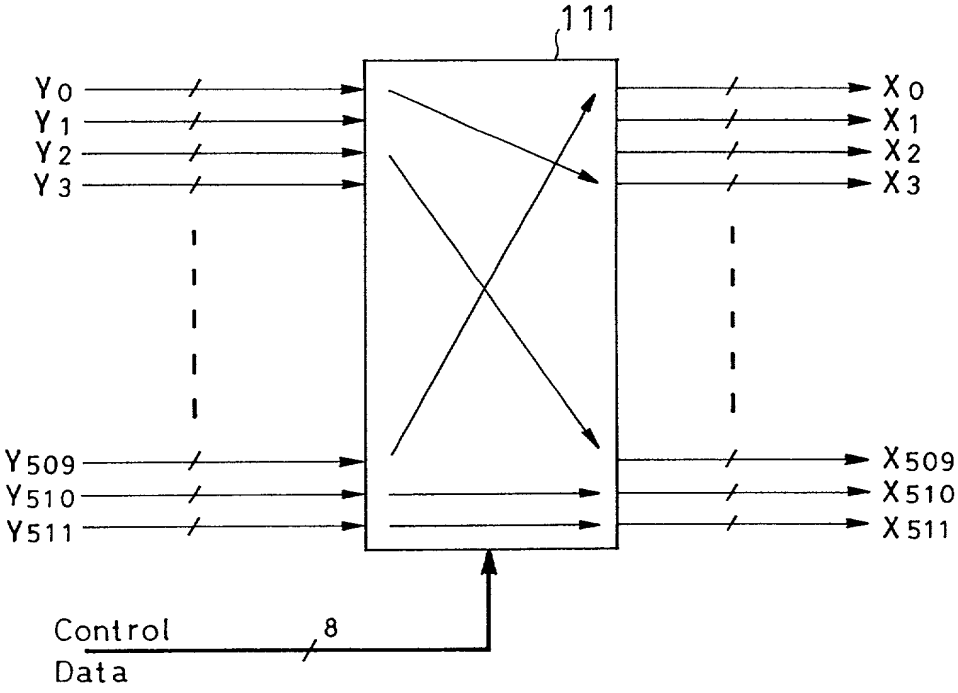


FIG. 5



EP 0 625 760 B1

FIG.6

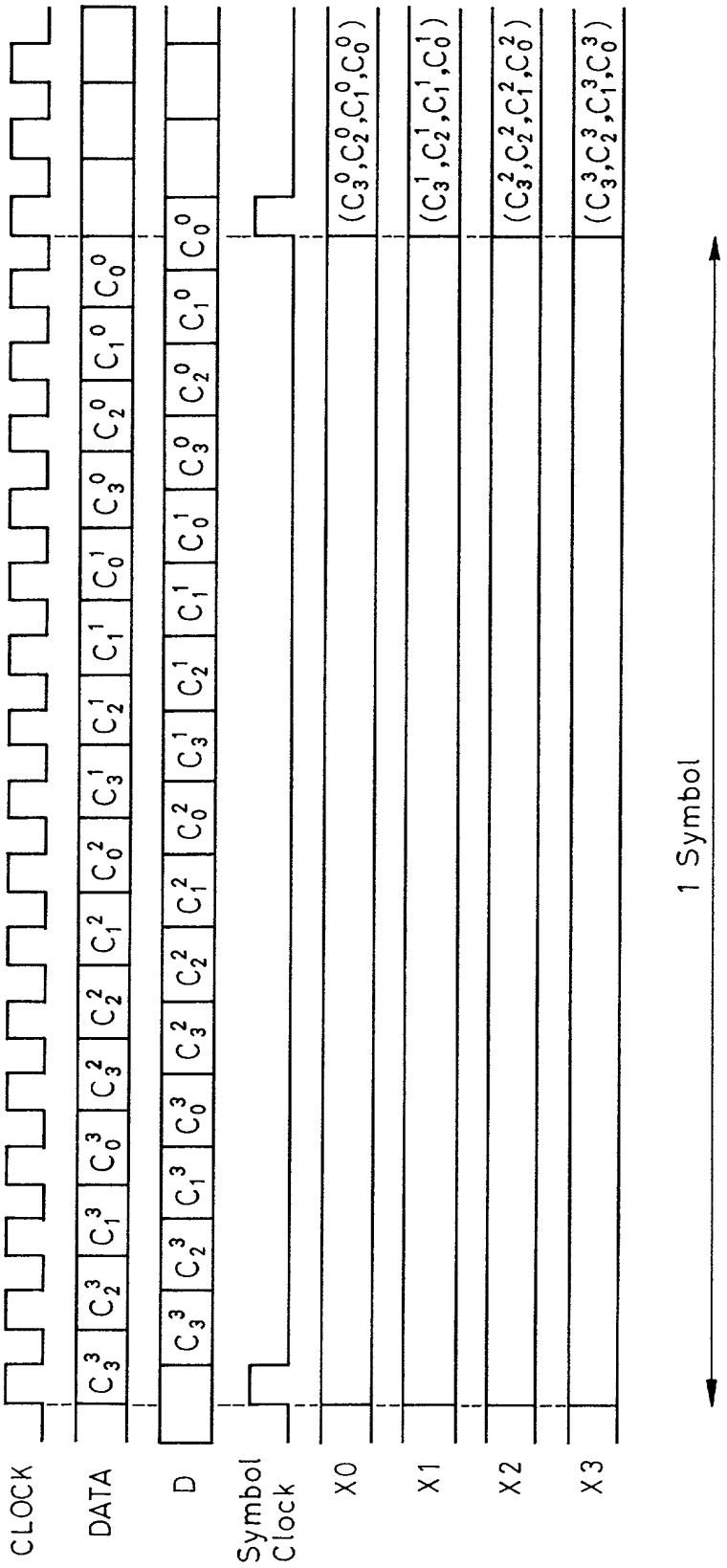


FIG. 7

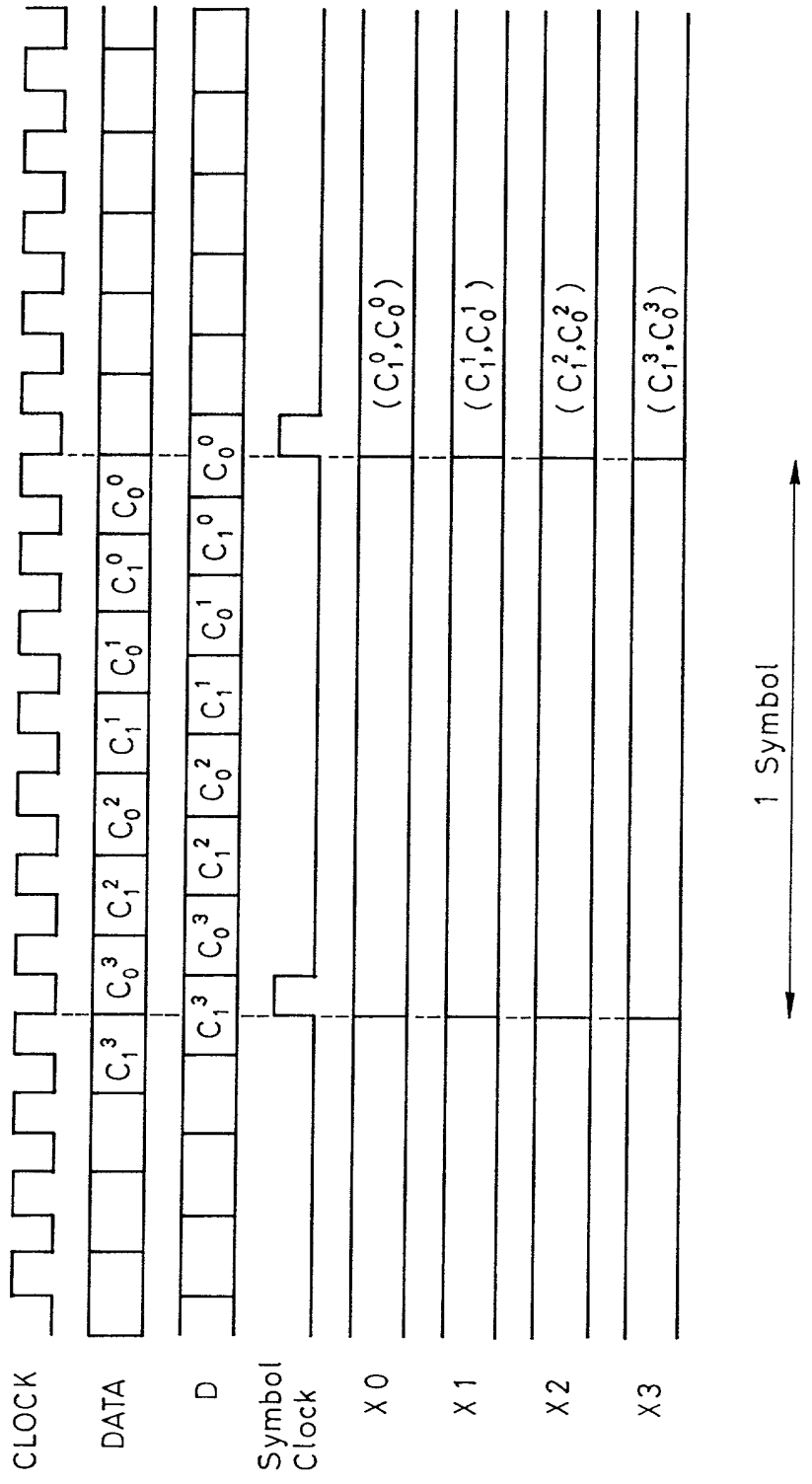
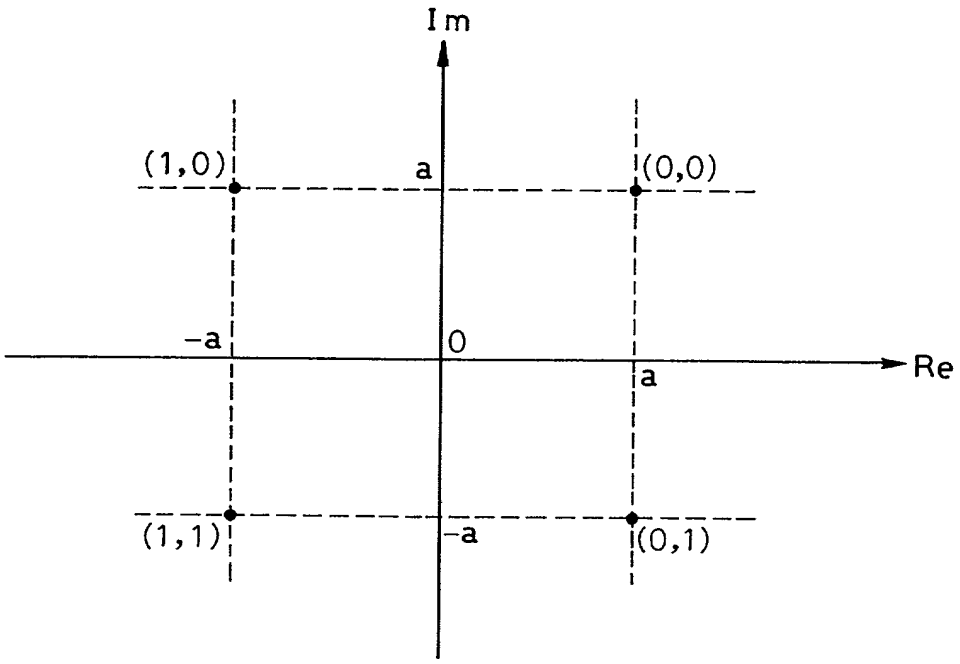

CLOCK
DATA
D
Symbol Clock
X 0
X 1
X2
X3
C_1^3 C_0^3 C_1^2 C_0^2 C_1^1 C_0^1 C_1^0 C_0^0
(C_1^0, C_0^0)
(C_1^1, C_0^1)
(C_1^2, C_0^2)
(C_1^3, C_0^3)
1 Symbol

FIG. 8



EP 0 695 096 A2

FIG.9

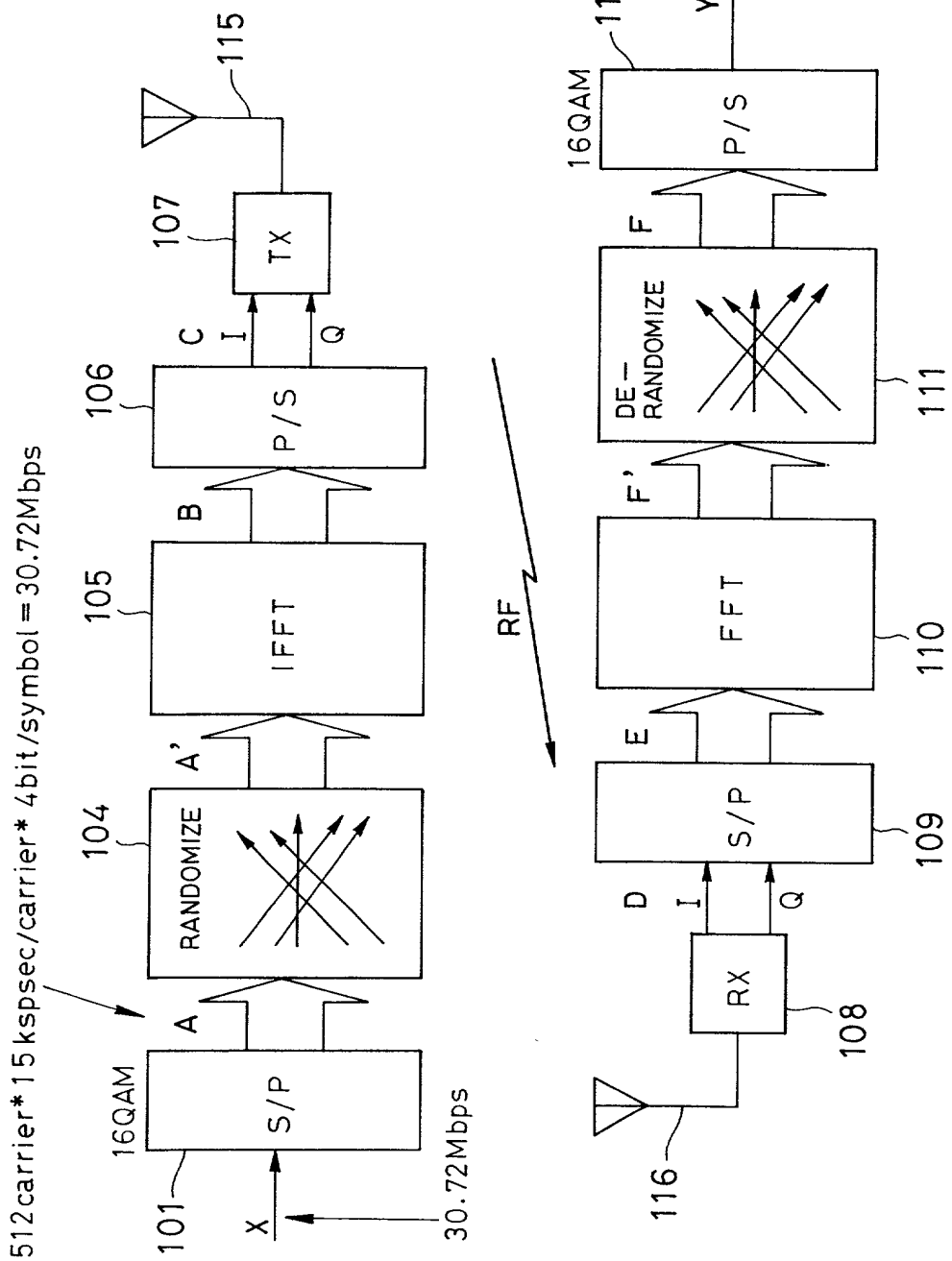

512carrier*15kspsec/carrier*4bit/symbol=30.72Mbps
30.72Mbps
X
101
16QAM
S/P
A
104
RANDOMIZE
A'
105
IFFT
B
106
P/S
C
I
Q
107
TX
115
RF
116
RX
108
D
I
Q
S/P
109
E
110
FFT
F'
111
DE-
RANDOMIZE
F
112
16QAM
P/S
Y

FIG.10

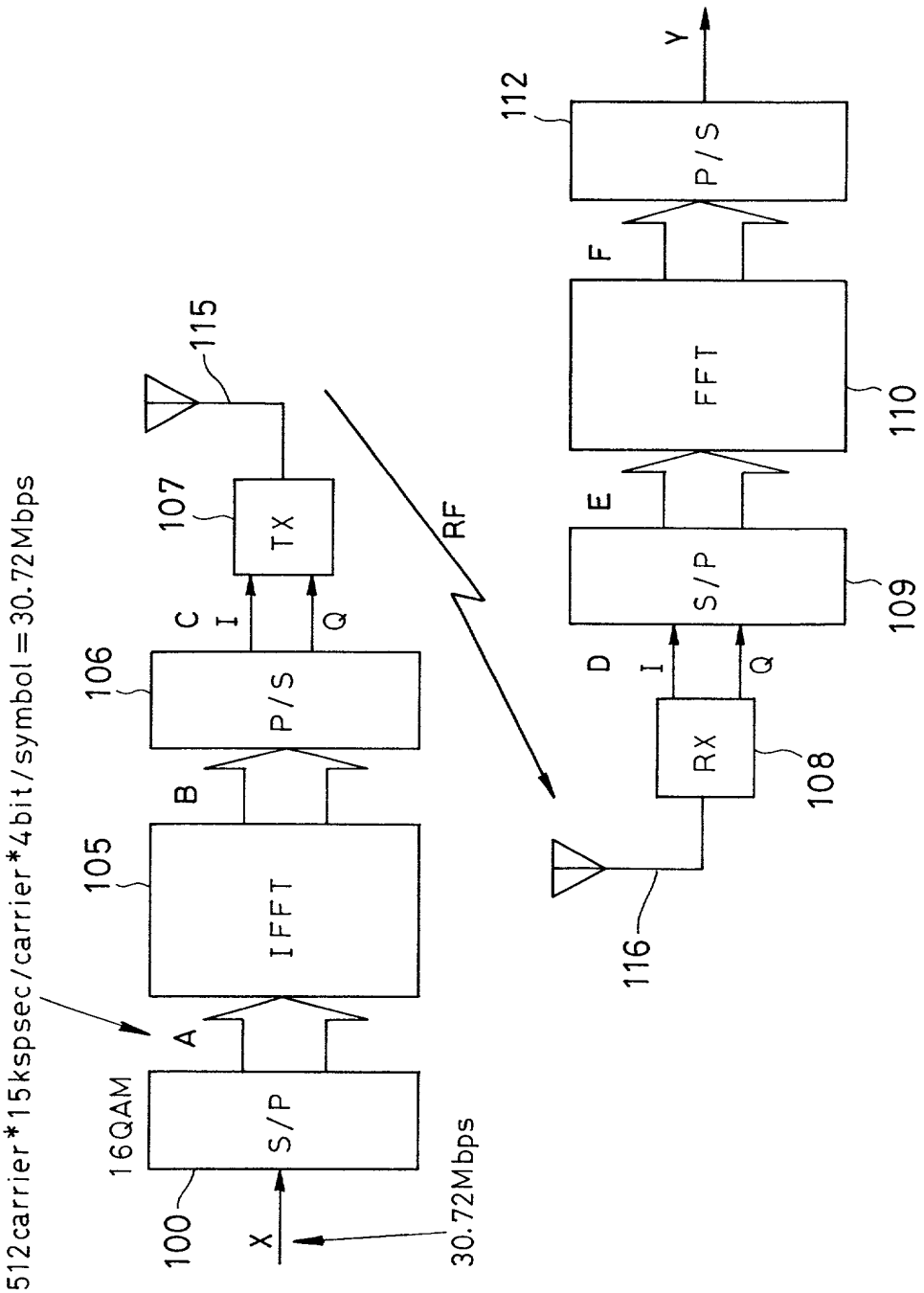

512carrier*15kspsec/carrier*4bit/symbol=30.72Mbps
16QAM
S/P
100
X
30.72Mbps
A
IFFT
105
B
P/S
106
C
I
Q
TX
107
115
RF
116
RX
108
D
I
Q
S/P
109
E
FFT
110
F
P/S
112
Y

FIG.11

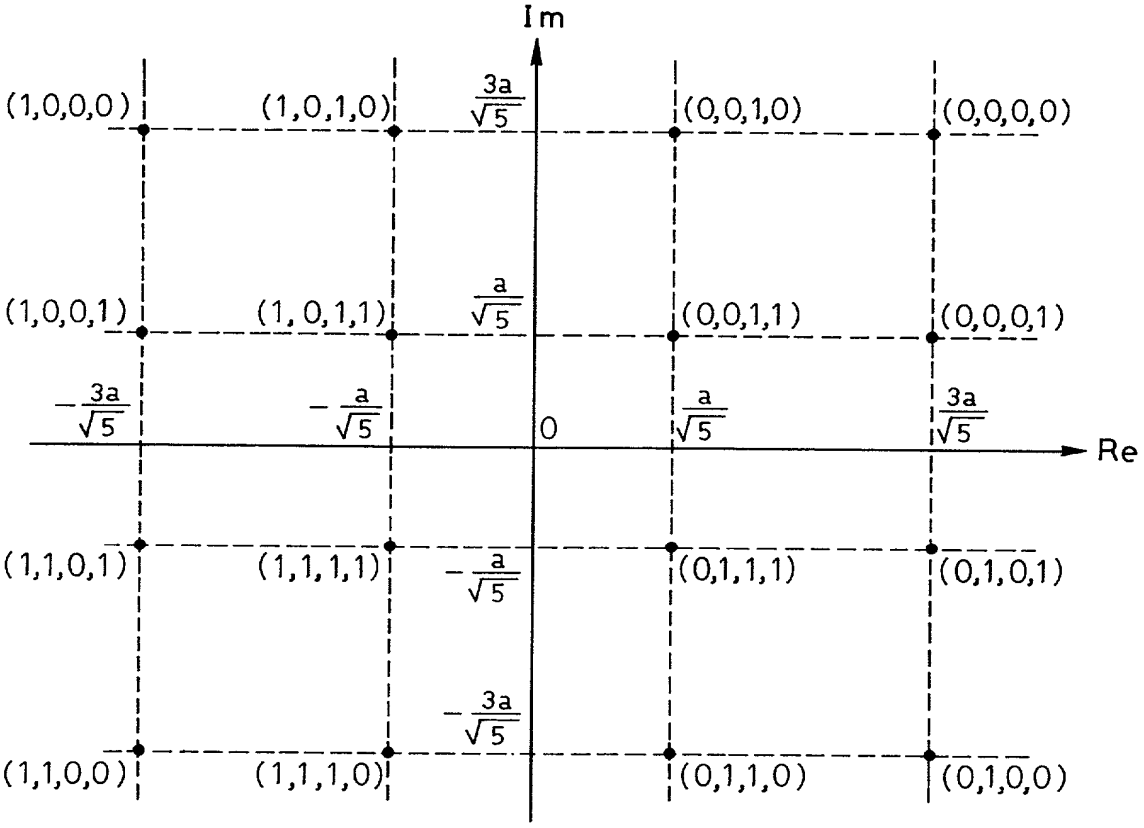
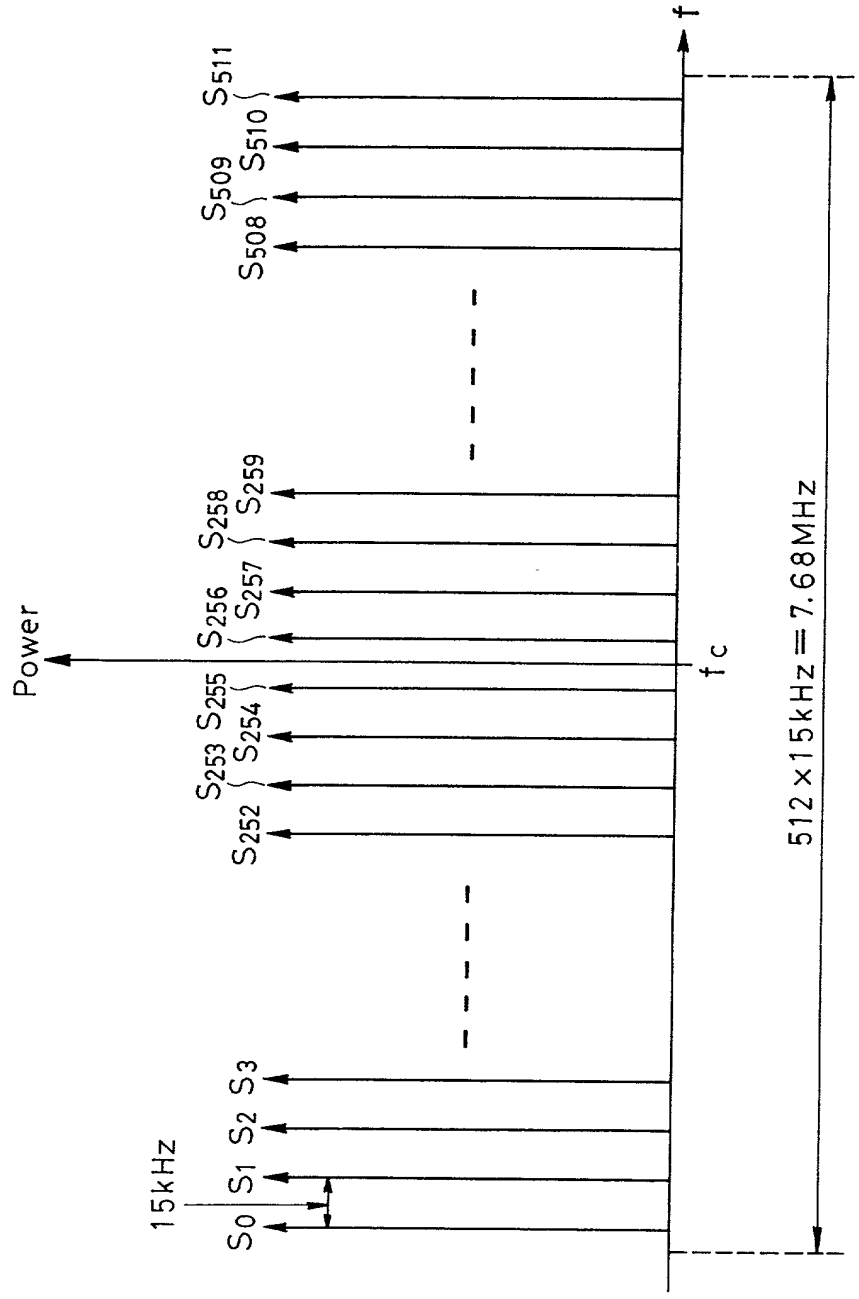

Im
Re
(1,0,0,0)
(1,0,1,0)
(0,0,1,0)
(0,0,0,0)
(1,0,0,1)
(1,0,1,1)
(0,0,1,1)
(0,0,0,1)
(1,1,0,1)
(1,1,1,1)
(0,1,1,1)
(0,1,0,1)
(1,1,0,0)
(1,1,1,0)
(0,1,1,0)
(0,1,0,0)
$\frac{3a}{\sqrt{5}}$
$\frac{a}{\sqrt{5}}$
0
$-\frac{a}{\sqrt{5}}$
$-\frac{3a}{\sqrt{5}}$

FIG.12


Power
f
fc
15kHz
S0
S1
S2
S3
S252
S253
S254
S255
S256
S257
S258
S259
S508
S509
S510
S511
512×15kHz=7.68MHz